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Improving End User Value in Information Technology Projects: Exploring The Benefits of Q-sort Analysis

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IMPROVING END USER VALUE IN INFORMATION TECHNOLOGY PROJECTS: EXPLORING THE BENEFITS OF Q-SORT ANALYSIS

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ABSTRACT

The authors explore the use of Q-methodology to create more effective Information technology planning by identifying organizational sub-groups with different information technology requirements. The paper discusses the foundations of Q-Methodology and the special characteristics of the approach that deal effectively with the many subjective areas that are encountered during the development and implementation of a technology plan. A case study of an actual project that used Q-methodology is presented and discussed.

Keywords

Q-Sort, Q-Methodology, Long Term Technology Planning, Technology Implementation

INTRODUCTION

Many organizations contain user sub-groups that require different technology configurations to support the optimal achievement of their organizational responsibilities. Traditional approaches to analyzing user needs generally use nonmotheic (Likert based) techniques to identify technology capabilities that would support the primary needs of these users. This often results in a deployment configuration that is often sub optimal for most users by providing either more or fewer capabilities than is actually required by the individual user. The authors propose using the q-methodology to identify the sub-groups that require different technologies and thereby create the capability to develop a more economically efficient deployment that meets the actual technology requirements of the individual user.

The q-methodology differs from normative analysis by focusing on the qualitative evaluations of collections of individuals. The first section of the paper introduces the q-methodology and examines its capability to extract the actual priorities of individuals with respect to their personal perspectives on a topic with qualitative dimensions (e.g. what are the technologies that will best help you do your job). This approach enables each individual to determine the technology features that enable him to best achieve his perceived organizational responsibilities. The paper then discusses the use of the methodology to collect individuals into statistically distinct groups that contain common features. By examining the common priorities within each group, the structural elements required to support and sustain the efforts of each group can be determined. Operant categories can then be extracted that represent functional as opposed to merely technical distinctions.

The paper then presents and discusses the actual development of a technology deployment for a small university using the q-methodology to determine the technology needs of the academic and administrative users of the university's technology infrastructure. The paper concludes with a discussion of the opportunities to extend the use of q-methodology into other areas where subjective characteristics are important dimensions of the population being studied.

Q-METHODOLOGY

The Q-methodology was employed in accordance with the goals of this study to identify technology planning priorities for a 5-year horizon and provide information that may be used to plan resource allocation accordingly. Utilizing the Q-methodology entails the adoption of its guiding philosophy of preserving operant subjectivity, the guidelines for instrument development and measurement using the q-sort, and a specialized centroid factor extraction technique known as "q-factor analysis" (Green, 1978; Brown, 1980).

The preservation of operant subjectivity may best be described as the principle of allowing the subjects to speak for themselves in their own voice (Stephenson, 1953; Brown, 1980). The distinction is sometimes made between nomothetic and idiographic approaches to research design. Most empirical research is nomothetic in that it requires the a priori acceptance of a set of conditions that underlie the research, such as a set of variables or theoretical assumptions about the structure between variables. Idiographic research, on the other hand, preserves operant subjectivity because it begins with no a priori assumptions or conditions and proceeds by allowing the subject to arrange their own version of domain, thus allowing them to "tell their own story" (Bem and Allen, 1974). In the context of this study, the idiographic nature of the Q-methodology makes it appropriate for the identification and interpretation of the existing perspectives about long-term technology planning among a university's faculty and administration.

The Q-sort is the prescribed method of measurement for allowing subjects to tell their own story. In a q-sort, each subject is presented with a group of statements and instructed to sort the statements into a normally-distributed series of categories according to their sentiment (agreement, desirability, etc.) about each statement. Respondents are often asked to provide several Q-sorts under differing conditions of instruction, using the same set of statements. For example, participants may be asked to, "Sort the statements according to your personal preferences" followed by "Now sort the statements according to your organization's preferences". The different sets of Q-sorts may then be analyzed to determine whether there are differences between individual and organizational preferences, and if so the extent and nature of the differences.

Q-methodology prescribes a variant of centroid factor extraction called "q-factor analysis" for statistical support. Q-factor analysis is similar to the more familiar r-factorial methods, but differs distinctly in that it factors the subjects rather than the variables (Brown, 1980). Although some believe that q-factor analysis is a form of cluster analysis, which is an r-factorial method, q-factor analysis produces similar but noticeably different solutions than cluster analysis (Thomas and Watson, 2002). Q-factor analysis provides information useful for the identification and interpretation of groups, such as rank-ordering of the q-sort statements for each factor, rank ordering of statements by consensus and disagreement between pairs of factors, and distinguishing statements for each factor, to name a few.

Q-METHODOLOGY VS. OTHER METHODS OF ASSESSMENT

The Q-methodology has some important advantages for both researchers and practitioners. First, q-factor analysis places minimal burdens on the number of respondents. For instance, a recent study provided meaningful results with only n = 9 respondents (Thomas and Watson, 2002). This advantage is due primarily to the ability of q-factor analysis to operate with minimal data, which results partly from requiring respondents to rank statements into a quasi-normal distribution and partly from the goals of q-factor analysis to discriminate between individuals (Stephenson, 1953; Brown, 1993). Secondly, in order to preserve operant subjectivity, the q-methodology requires respondents to consider an entire domain of q-statements before ordering their version of the domain, which means that the ranking of a Q-statement in any given Q-sort are dependent on the rankings of all other statements. This is in stark contrast to r-factorial methods which assume that the respondents respond to each test item independently of all other tests in the domain. In other words, the q-methodology requires respondents to consider the "big picture" before arranging their own subjective version of the picture, whereas r-factorial methods typically require that respondents be tested according to the researcher's a priori "big picture" of the domain. Hence, a Q-sort represents an individual's coherent point-of-view on the domain.

Profile analysis is a form of MANOVA that answers the questions of whether two sets of responses are level, coincident, parallel, or dissimilar. Like most correlational methods, profile analysis places demands on sample size and makes distributional assumptions about the data (Tabachnick and Fidell, 1989). IT audits and inventories (and by extension gap analysis) are typically used to measure the levels technological deployment and usage in an organization. Like the Q-methodology, an IT audit also may proceed with a small sample and allow individual respondents to be compared to the larger group. However, with the exception of sample size requirements, IT audits and inventories suffer from the same statistical disadvantages as profile analysis.

PILOT STUDY AND INSTRUMENT DEVELOPMENT

Pilot testing was accomplished in two phases: 1) the development and refinement of a set of statements throughout a cycle of meetings of the university's Technology Planning Committee, and 2) the collection of a small sample of data (n < 30) accompanied by a preliminary analysis. In phase one, a set of q-sort statements was developed collaboratively by members of the committee, each representing their own department. Committee members then solicited additional feedback both from other members of their own department and other departments not having representation on the committee, until the committee was satisfied that the set of Q-statements was adequate enough to represent the variety of technology planning perspectives across the university. In phase two, a small sample was drawn for the purpose of pilot testing both the administration of the q-sort set and the statistical analysis technique to be applied. The results of the pilot study indicated that the q-sort instrumentation was both representative of the technology planning perspectives among the university's constituents and adequate as a tool for primary data collection.

Measurement

The measurement proceeded according to the guidelines of the Q-methodology as developed in previous research (Stephenson, 1953; Bem and Allen, 1974; Thomas and Watson, 2002) by administering a profile of technology planning-related statements (Appendix 1). Each respondent was asked to sort the statements into categories based on their perceived desirability. In accordance with the guidelines for the Q-methodology, the respondents were instructed to sort specific numbers of statements into different categories, with fewer variables in the extreme categories (very desirable – very undesirable) and more in the moderate categories (somewhat desirable – somewhat undesirable) so that the respondents were forced both to make value judgments and to place the variables in a form of normal distribution. The respondents were additionally instructed, in accordance with established guidelines (Brown, 1980; Thomas and Watson, 2002), to sort "from the outside in", that is, to begin by sorting statements into the extreme categories and working their way inwards to the less extreme categories.

Sample and Data Collection

The primary data collection proceeded by requesting two representatives from each administrative unit of the university to complete the q-sort procedure. Instructions were given that departmental representatives should be acquainted with both the current technological environment and the ideal technological environment desired by their department in 5 years. In all, there were n = 40 responses, of which n = 35 were complete and done correctly according to the q-sort procedure. Qualitative feedback obtained from the respondents indicated that the paper-based method of q-sorting was effective in engaging participants in the judgmental process of interacting with the entire set of q-statements before sorting the items. Specifically, several respondents voiced their preference for a traditional survey that did not require them to read the entire instrument before recording their responses.

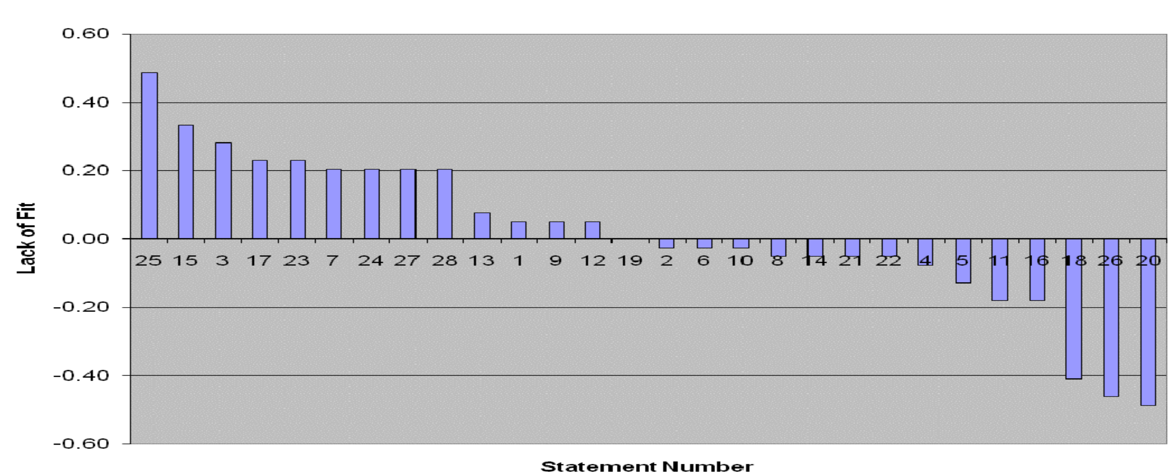
RESULTS, ANALYSIS, AND DISCUSSION

The authors present two different managerial decision tools that are supported by the Q-methodology: a lack-of-fit chart and a Q-factor analysis. A lack-of-fit chart is a graphical representation of the differences between the current technological environment and the future planned technological environment. Hence, the lack-of-fit is the difference between the current technological environment and the future planned environment across a broad range of technology planning variables. Q-factor analysis is a statistical representation of the types of technology planning perspectives that are manifest among the planning participants. Q-factor analysis correlates the perspectives of the participants in the same way that ordinary factor analysis correlates clusters of variables. The factors, as such, correlate people with similar perspectives, whereas a factor in an ordinary factor analysis is a group of correlated measured variables.

Lack-of-fit chart

Figure 1 represents the average lack-of-fit for each technology planning priority. Average lack-of-fit is computed by subtracting the present technological priority from the planned future priority for each item, divided by the number of q-sorts. The differences are then sorted in descending order from greatest difference to least difference. Future planning priorities that are greater than their respective present priorities reflect an increasing priority over time and appear on the left side of the chart (positive lack-of-fit), while future planning priorities that are less than their respective present priorities reflect a decreasing priority over time and appear on the right side of the chart (negative lack-of-fit).

Figure 1. Technology Planning: University-wide Lack of Fit



As a decision tool, the chart indicates resource allocation needs over the term of the technology planning. Resources may be diverted from priorities with negative lack-of-fit towards priorities with positive lack-of-fit. Specifically, the chart indicates that there is currently a higher priority than is necessary (negative lack of fit) for (in order):

Statement #	Higher than necessary priority (negative lack-of-fit)
20	Consultation with IT Dept. when purchasing new technology
26	Adequate public computing resources
18	Presentation technology
16	Improving methods to evaluate and assess customer service
11	Improving methods to evaluate and assess productivity
5	Identify and define areas where existing electronic services may be improved
4	Discipline-specific software/ hardware
22	Improved media scheduling
21	Automated attendance systems
14	Online portal for recruiting and admissions
8	Advanced audio-visual technologies
10	Student information portal to communicate procedures, policies, and services
6	Improved customer service training for available technologies
2	Identify and define areas where technology can improve customer service

Resources that are currently allocated to these priorities may be diverted or re-allocated to the following priorities with positive lack-of-fit that will increase in importance over time (in order):

Statement #	Lower than necessary priority (positive lack-of-fit)
25	Access to a university-wide data warehouse to support administrative effectiveness
15	Automated registration systems
3	Improved technology training for adjuncts
17	Discipline-specific labs
23	Adequate wireless access
7	Enhanced Blackboard tools
24	Identify and define what information to collect and how it should be used
27	Offer large classes online
28	Automated advising systems
13	Faculty orientation for available technologies
1	Open labs
9	Online alumni services and resources
12	Improved technical support

Q-factor analysis

As in ordinary factor analysis, the goals of Q-factor analysis are to produce a set of factors that both maximize the explanatory power of the factors and minimize the complexity of the solution. In other words, the goal is to find the most parsimonious solution that does the best job of explaining the data. Also, as in ordinary factor analysis, since there are an infinite number of solutions the analyst should use generally established guidelines to systematically compare the results of multiple proposed solutions, and the resulting factors must be interpretable by “common sense” in addition to being statistically acceptable.

To accomplish this, for each solution the between-factor correlations are compared with the amount of variance explained by that particular solution. A desirable solution will generally explain more than 40% of the variation in the data while producing relatively insignificant correlations between factors. The “common sense” interpretation is done by examining and analyzing the technology planning priorities associated with each factor with the goal of defining the factor in a manner that is faithful to the perspectives of its constituents. Open-ended explanations of q-sorts are solicited from the participants to support this goal.

Following these general guidelines, a five factor solution produced uncorrelated factors that explain 42% of the variance in the data. Operationally, the factors represent “types” of technology planning perspectives manifested among the constituents. Table 1 (Appendix) reports the results of the Q-factor analysis. The factor loadings represent the correlation between any given person’s technology planning perspective and each respective technology planning “type”. Factor loadings in boldface represent “exemplars” whose perspectives are most highly correlated with that particular technology planning type.

By means of rankings, Table 2 (Appendix) reports the technology planning priorities associated with each planning type. Types 1, 2, and 5 (below) were represented by exemplars only at the positive end of the factor. Operationally, this means that only the positive priorities are important for planning purposes, and the negative priorities may be ignored for all practical purposes. Types 3 and 4 (below) were represented by exemplars at both the positive and negative end of the type. Operationally, this means that there were people with opposite perspectives on the same factor, with the lowest priorities of those at the positive end of the factor being the highest priorities of those at the negative end of the factor, and vice-versa. In such cases attention must be paid to both positive and negative planning priorities, since both perspectives are represented among the constituents.

Type 1: The student-centered mission of the university

The Type 1 perspective is characterized by emphasis on the technology planning priorities associated with instructional support technologies for students (Table 3- Appendix). This type reflects the student-centered mission of the university and its embodiment in the attitudes of the university administration. No faculty in this study shared this perspective.

Type 2: Business Analytics

The Type 2 perspective is characterized by emphasis on the technology planning priorities associated with administrative operations support (Table 4- Appendix). The priorities of Type 2 are those of a business analyst: evaluation and assessment, consultation, and data management, and generally represent the desire of the university administration to maintain a “culture of evidence”. There were no faculty exemplars of the Type 2 perspective.

Type 3: Instructional Technology

There were exemplars at both the positive and negative poles of the Type 3 perspective. Accordingly, both positive and negative planning priorities have practical value for planning. The Type 3 perspective is characterized by emphasis on the positive technology planning priorities associate d with supporting instructional activities and the negative priorities associated with increasing computer based support services (Table 5- Appendix).

The bipolar nature of Type 3 is representative of diametrically opposed perspectives on institutional priorities between a segment of the faculty and the administration, which are being manifested in their conflicting perspectives on the role of technology in the university. For planning purposes both perspectives are important and should be implemented in the long-term technology plan, since the goal is to plan for the entire university – it is not an either/ or decision.

Type 4: Administrative Purpose

The Type 4 technology planning perspective is also represented by exemplars at both the positive and negative poles of the factor. The Type 4 perspective is characterized by emphasis on the positive priorities associated with training and support and the negative priorities associated with increasing automated assessment and instructional support (Table 6- Appendix).

Type 4 represents two different perspectives within the university administration. There is some similarity of Type 4 to Type 2 and the negative pole of Type 3. Although these three administrative perspectives share much in common, they differ over whether technology planning priorities should target student services or administrative efficiency.

Type 5: Technology supports core mission and values

The Type 5 technology planning perspective is characterized by emphasis on the priorities associated with improving the operational effectiveness of the technology (Table 7- Appendix).

The Type 5 perspective emphasizes the role of technology to support the core mission and values of the university. In other words, technology is merely a tool that may be used to release university personnel from mundane tasks so they may focus on higher-order functions of the organization.

CONCLUSION

Q-sorts offer the capability to effectively capture and analyze subjective data in a manner that enables the diverse views of a quasi heterogeneous group of individuals to be incorporated effectively into the planning and design of information systems implementation project. The project discussed in this paper demonstrated the effective use of Q-methodology to enhance the technology planning process and improve the utilization of available resources.

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APPENDIX

Appendix containing the tables of data discussed to in the body of the article is available from the author upon request.